The Meteorological Magazine

Air Ministry :: Meteorological Office

Vol. 57
Sept. 1922
No. 680

LONDON : PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

To be purchased through any Bookseller or directly from
H.M. STATIONERY OFFICE at the following addresses :
IMPERIAL HOUSE, KINGSWAY, LONDON, W.C. 2, and 28, ABINGDON STREET, LONDON, S.W. 1;
37, PETER STREET, MANCHESTER ; 1, ST. ANDREW'S CRESCENT, CARDIFF ; 23, FORTH STREET,
EDINBURGH ; or from THE METEOROLOGICAL OFFICE, SOUTH KENSINGTON, LONDON, S.W. 7.

A Period of Warm Winters in Europe.

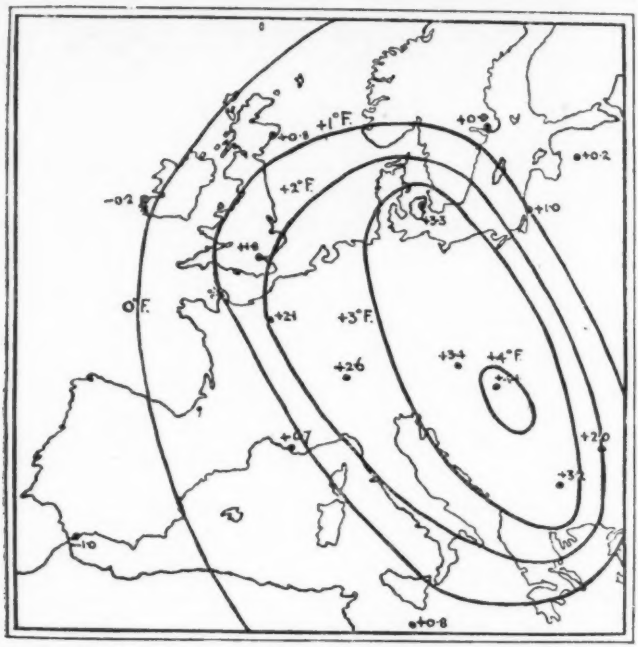
BY C. E. P. BROOKS, M.Sc.

AMONG the most interesting problems of meteorology are the local changes of climate extending over years or even decades. Their causes are usually obscure and often the most that can be said is that they are secondary effects of long-period fluctuations in the circulation of the earth's atmosphere. An example which has recently come to light is the abnormal winter warmth of Central Europe during the decade 1911 to 1920.

The differences between the mean temperatures for January, February and December of the years 1911 to 1920, and the long-period averages for the several stations (usually covering the years 1851–1910), are shown in the chart on p. 204, from which it appears that the maximum effect, exceeding 3° F., extends in a long belt from Denmark (Copenhagen + 3·3° F.) to the Balkan Peninsula (Sofia + 3·2° F.). At Budapest, near the centre of this area, the difference exceeds 4° F.; that is to say, the winters of the past ten years at this town have on the average been more than four degrees warmer than the normal winter. From the central isanomaly of 3° F. the excess falls off rapidly in all directions except the west, where it is 2·6° F. at Zürich, 2·1° F. at Paris and 1·8° F. at Kew. On the Atlantic sea-board the winters of the decade in question have been slightly colder than the normal.

Over most of the area the effect reaches its maximum in December and is also well developed in the early spring. For the rest of the year there is no appreciable difference; in fact, during the summer months, the years 1911 to 1920 have been on

x (64)18520 Wt 69—P 1 1000 9/22 E & S A



DIFFERENCES BETWEEN THE MEAN TEMPERATURE, WINTER MONTHS 1919–1920, AND THE CORRESPONDING LONG-PERIOD MEANS.

the average somewhat cooler than the normal in Central Europe, though the difference nowhere reaches 2° F. The mean annual temperatures have been as much as 1·5° F. above the normal.

Failing registering balloon ascents, the data of St. Gothard (6,877 feet) have been examined to discover if the phenomenon is confined to low levels. At this station the mean winter temperature (1911 to 1920) is 1·9° F. above the long-period normal, while at Zürich (1,542 feet), a short distance further north, the difference is 2·6° F. The abnormal warmth was therefore not confined to low levels and is probably not a radiation effect.

We have here an appreciable change of climate which appears to be analogous to the Brückner cycle, but not identical with it, because the Brückner cycle should give low instead of high temperatures during the past decade. A tentative explanation connects it with the general decrease of sunspot numbers since the nineteenth century. Sunspot numbers are an index of the intensity of the solar radiation, which governs the strength of

the earth's atmospheric circulation. Now a by-product of this circulation is the gradient between the sub-tropical Atlantic anticyclone and the Icelandic minimum. The nearest point to the former for which recent data are available is Lisbon, and we find that during the period 1911 to 1918 the mean winter pressure at Lisbon was 0·5 mb. below the normal, while at Iceland it was 1·2 mb. above normal, decreasing the mean gradient between these two places from 21·2 mb. to 19·5 mb. At first sight this should mean decreased south-westerly winds from the Atlantic and consequently *lower* winter temperatures over Central Europe, but it happens that the winter weather in this region is mainly anticyclonic and is only slightly affected directly by the Atlantic pressure gradient. Its severity is, however, very much lessened when frequent depressions break through, and this happens most readily when the atmospheric circulation is weakest and the oceans are, accordingly, relatively cold.

When the air circulation is strong, that of the ocean is strong also, and in temperate latitudes the waters are highly warmed so that depressions follow the coasts and the continental anticyclones escape their influence.

This hypothesis in only tentative, but it agrees with Brückner's conclusions based on his studies of the 35-year cycle,[1] and also with those based on the study of the secular variation of the annual means of pressure and temperature since 1870.[2]

OFFICIAL NOTICE.

The Meteorological Committee.

The Board of Trade has appointed Capt. R. C. Warden, C.B.E., Principal District Officer of the Mercantile Marine Department for the London District, as their nominee on the Meteorological Committee to succeed Capt. D. Fulton, who died on March 20th, 1922.

Lectures on Meteorology.

THE following is the provisional programme of lectures and classes for the School of Meteorology of the Imperial College of Science and Technology in the session 1922–23.

1. General Course of twenty-one lectures by Captain D. Brunt on *Advanced Meteorology, Dynamical and Physical*, on Mondays at 3.30 p.m. during the winter and spring terms, beginning on Monday, October 9th, 1922.

---

[1] *Klimaschwankungen seit 1700.* Wien, 1890.

[2] Brooks, C.E.P. *The Secular Variation of Climate.* Geogr. Rev., New York, N.Y., 11, 1921, p. 120.

2. Technical courses :

(*a*) Seven lectures by Sir Napier Shaw, F.R.S., on *Meteorological Conditions of the Air-Routes of the World*, at 3 p.m. on Fridays, October 13th, 20th and 27th and November 3rd, 10th, 17th and 24th.

(*b*) Three lectures by Mr. R. A. Watson-Watt on *Wireless Telegraphy and Weather*, at 3 p.m., on Fridays, December 1st, 8th and 15th.

3. An open course of ten lectures on *Forecasting Weather* by Sir Napier Shaw, F.R.S., on Fridays at 3 p.m. during the spring term, beginning on Friday, January 19th, 1923.

4. Discussions on the *Incidents of the Weather Charts of the previous week*, on Saturdays at 10 a.m. during term-time throughout the year, beginning on Saturday, October 14th, 1922.

Further particulars of these courses may be obtained from The Secretary, Imperial College of Science and Technology, South Kensington, S.W.7.

Discussions at the Meteorological Office.

The series of meetings held at the Meteorological Office, South Kensington, for the informal discussion of important contributions to meteorological literature, especially in foreign and colonial journals, will be continued this year.

The meetings will be held on Mondays at 5 p.m. on the following dates :—October 16th and 30th; November 13th and 27th; December 11th, 1922; January 22nd; February 5th and 19th; March 5th and 19th, 1923.

At the first meeting, October 16th, Sir Napier Shaw, F.R.S., will open the discussion of a paper by V. Bjerknes "On the dynamics of the circular vortex with application to the atmosphere and atmospheric vortex and wave motions." *Geofysiske Publikationer*, Vol. II., No. 3.

The Editors wish to thank the many readers who have volunteered to transcribe the 18th century diary lately presented to the Meteorological Office Library, and to state that the work has now been taken in hand.

Meteorological observers are reminded that Summer-Time will cease on October 8th, at 2 h. G.M.T.

Correspondence.

To the Editors, *The Meteorological Magazine.*

The Underground Water Level in the neighbourhood of the North and South Downs.

Some account of the underground water level at Detling was published in *The Meteorological Magazine* for May, 1922. Further investigation now shows that the marked deficiency in the underground water supply of the North Downs is still continued.

The following table compares the water level in 1922 with the average for 1911–1921. Wells 1, 2 and 3 are deep-seated and are situated on the gentle dip slope of the northern escarpment of the North Downs, No. 4 is low on the southern escarpment and No. 5 slightly lower still. All are, therefore, in the belt of Middle Chalk. The depth varies from 270 feet to 62 feet and in each case the draught is extremely slight.

Date.	(1) Hucking (Old Forge).		(2) Stockbury Village.		(3) Little Pett.		(4) Detling (The Croft).		(5) Detling (Naylor's).	
	1922.	Aver. 1911–1921.	1922.	Aver. 1911–1921.	1922.	Aver. 1911–1921.	1922.	Aver. 1911–1921.	1922.	Aver. 1911–1921.
	feet	feet	feet	feet	feet	feet	feet	feet	feet	feet
May 1 -	38·3	65·9	33·11	42·7	21·1	58·1	0·0	22·7	1·3	15·4
June 1 -	31·2	67·7	30·7	42·1	21·1	59·1	0·0	20·1	0·9	13·1
July 1 -	29·2	66·2	27·1	43·2	19·1	58·6	0·0	18·9	0·2	11·9
Aug. 1 -	35·0	64·5	28·3	41·9	19·8	55·4	1·0	16·5	0·0	10·0

This abnormally low level is not indicated in the chalk district of west Sussex, the southern South Downs, a fact well shown by the figures for Chilgrove, given below :—

Date.	Chilgrove.		
	1922.	Average 1911–1921.	Average 1836–1919.
	feet	feet	feet
April 30 - - -	61·0	65·8	55·0
May 31 - - -	50·7	54·3	46·0
June 30 - - -	39·5	39·1	38·0
July 31 - - -	30·5	30·8	30·0

At Compton, in the same neighbourhood, the level at the end of May 1922 was higher than in 19 of the previous 29 years. Comparative rainfall for the two areas as exemplified by Detling and Chilgrove is also significant :—

Period.	North Downs (Middle Chalk). Detling.			South Downs (Upper Chalk). Chilgrove.		
	Average. 1885-1919	1920-1921.	1921-1922.	Average. 1836-1919	1920-1921.	1921-1922.
	in.	in.	in.	in.	in.	in.
Winter (Oct. 1 to March 31).	15·23	9·77	11·34	19·23	15·75	15·99
Summer (Apr. 1 to Sept. 30).	12·92	6·64	—	15·08	6·88	—
Jan. 1 to July 31	—	—	16·07	—	—	21·72

Three factors appear to contribute to the marked difference in the underground water level in the two areas.

Firstly, the extreme deficit in rainfall for the period October 1920 to October 1921, though noticeable in both districts, was less marked at Chilgrove. Secondly, the presence of more open strata and of flint courses in the Upper Chalk zone permits of much freer percolation than is possible in the relatively impermeable Middle Chalk zone. Lastly, pumping is carried out to a great extent in the region of the North Downs, owing largely to the presence of such towns as Rochester and Chatham, while in the South Downs such pumping is very limited. Experience has shown that under normal conditions pumping affects the water level for a short time only—some five or six hours—but it is probable that after a sequence of dry seasons it tends to lower the underground level in a marked degree.

Spencer Russell.

Fonthill Cottage, Dorking, August 1922.

Cigar-shaped Clouds: Observations near the South Downs.

On the evening of Monday, June 12th, near Washington, Sussex, I observed a cloud formation of a striking character. The day had been warm; on the crest of the downs the sea-breeze sprang up about midday and persisted all the afternoon. A few minutes before 19h. G.M.T. I noticed a dull coloured patch of lower cloud, perhaps cumulus, contrasting with the white upper cloud, cirro-stratus. The upper cloud was apparently moving from the north and was soon clear of the lower. At that time the lower cloud developed very rapidly until it assumed the form of a great cigar or a zeppelin. This cigar-cloud lay nearly parallel

to the crest of the downs and perhaps two miles away. There was nothing to suggest a whirling movement in the cloud until a later stage, when it looked more like a distaff. By that time the cloud had moved a considerable distance to the north and the omnibus which I had mounted was overtaking it. About the same time two more clouds of the same shape, though smaller and not so perfect, had formed between the first and the downs. A fourth which formed about 19h. 20m. proved the most persistent of all. Number one evaporated just before number four reached its best development. The stereoscopic effect was well marked throughout, as the axes of the zeppelins were pointing towards the sun.

It is difficult to place these clouds in any of the well-known classes. They did not suggest the crests of waves such as might be formed in the air streaming over the downs. The analogy of the eddies formed by an obstacle and drifting downstream with the current is inviting, but is is difficult to account for sufficient cooling to allow of condensation in the centre of each eddy since there was no direct evidence of violent movement. It is possible that the clouds marked the transition between the sea breeze below and the return current above.

I should like to have references to similar observations.

July, 1922. F. J. W. WHIPPLE.

I DO not know that I have ever seen anything quite like that which Mr. Whipple describes. I have seen zeppelin-shaped clouds, but at cirro-cumulus heights. These I have seen many times with north-westerly winds both in Hampshire and on Salisbury Plain. I have one or two not very good photographs. I have seen similar clouds in the south of France with the mistral blowing.

I have also seen whale-black clouds over the downs, but these were actually resting on the hills; they are obviously caused by a wind that is blowing over the downs, condensation taking place where the air is forced upwards, and evaporation taking place on the leeward side. These clouds are wonderfully smooth in their outlines: they follow the hill contours, making an appearance as though the hills had suddenly grown higher. The appearance is very well described by Richard Jefferies in *Wild Life in a Southern County*. I fancy these clouds are very common over the downs near Freshwater. In such clouds the whole upper part of the cloud is perfectly smooth, like the surface of a stream when it just begins to go over a waterfall. C. J. P. CAVE.

Stoner Hill, Petersfield, July 15th, 1922.

Meteorology and Folklore.

Clouds.

RUSKIN has called the attention of an indifferent modern world to the beauties of the sky, to the changing panorama of cloudland, ranging from the delicate tracery of cirrus to the solid majesty of cumulus.

Nor was primitive man indifferent to the fascination of the sky-scape. The ancient Indians saw in the white summer clouds the Apsaras (" those who go in the water "), beautiful swan-maidens bathing in the heavenly lake. The Norsemen, seeing the ragged clouds driven before a sou'wester or hanging round a desolate mountain top, thought of the Valkyries (also on occasion " swan-maidens ") riding through the air on their white steeds, from whose manes dropped the frost and dew. It is remarkable how the spirit of this ancient meteorological myth has been embodied by Wagner in Act III. of *Die Walküre*, " a drama," as one critic half-jestingly said, " in which clouds play the leading role." Somewhat similar is the Tartar myth of the swan-women, of whom there are forty, but who can run together into one, so that at one time there is but one and at another the sky is dark with their wings.

Sometimes clouds assume a boatlike form. Such a formation has received various names, " Noah's Ark," a " sea-ship," a " cloud-ship " or " Mary's ship," and is regarded as a weather prognostic. But at one time it had a crew: it was the " Ship of Souls." A wild tale, current in Cornwall, tells how, as a pirate (in some versions a witch) was dying, a phantom ship came up in a cloudy squall and carried off his soul. Agobard, Bishop of Lyons in the ninth century, has left on record that many in his day believed in a country called Magonia, whence sailed ships among the clouds, whose crews poured down hail and tempests.

The Greeks believed the white clouds to be Apollo's white cattle shepherded by the wind Mercury. As they probably meant cirro-cumulus or cumulus it is easy to see how this myth was suggested by the woolly aspect of the clouds in question, the former being popularly known in France as " Moutons " and in Germany as " Schäfchenwolken." In Buckinghamshire they are called " packet-boys," and are said to be packets of rain soon to be opened. In conclusion it may be interesting to mention the convenient way in which the people of Southern Germany formerly accounted for weather changes—they were all Frau Holle's domestic activities. White clouds were her linen, grey her spinning threads, when it snowed she was shaking her bed, and last but not least rain was the result of her having a washing day!

CICELY M. BOTLEY.

10, Wellington Road, Hastings, August 1st, 1922.

Cloud Nomenclature.

Is not Dr. R. Sutton under a misapprehension in thinking "some observers would call the 'cirro-stratus' *alto-stratus*"? I was under the impression that they were distinctly different forms of cloud, the former being some eight kilometres above the earth's surface (about five miles), whilst the latter's altitude was only about six kilometres (about $3\frac{1}{2}$ miles). Also, the appearance of cirro-stratus is entirely different from that of alto-stratus. Cirro-stratus is feathery, like real cirrus, whilst alto-stratus is the thick grey pallium through which we see the "watery" sun or moon, which is so frequently a precursor of rain.

D. W. HORNER, F.R.Met.Soc.

Tunbridge Wells, Aug. 23rd, 1922.

Shallow East Winds.

THE following observations were noted on the Western and King's Esplanades, Hove.

At 11h. on Friday, July 21st, 1922, there was a gentle easterly breeze at 25 ft. above the sea, at 50 ft. it was south-easterly, but the coastguard vane, about 85 ft. high, was steady at south-west. There were light cumulus clouds at no great height above it, the smoke from the Portslade gas works chimneys, a mile distant to the west, also came from south-west, while the upper clouds, broad bands of cirrus, lay from south-south-west to north-north-east. No change took place until about 14h. 30m. when the surface wind became very feeble, the direction being unsteady between east and south-east.

Some two months ago a similar phenomenon was witnessed from the coastguard station (at the end of the esplanade), where a light easterly breeze was blowing. At about 11h. a pleasure steamer left the Brighton West Pier on a south-west course, her smoke not ascending above the funnel, but drifting, at one uniform level, in a continuous, sharply defined line from west-south-west towards east-north-east across eastern Brighton. When the steamer reached a point due south of the Hove coastguard station the smoke quickly backed round, and in less than a minute it was going in an equally well-defined line from east-south-east towards west-north-west, across Portslade, the two smoke lines remaining visible for some time, and attracting considerable attention.

In both cases the easterly wind layer would appear to have been less than 80 feet in thickness from the water.

H. HARRIES.

2, Wish Road, Hove, July 31st, 1922.

Simple Weather Forecasting.

WHEN "H." suggests "guessing" in his remarks, anonymity shows lack of courage. I enclose my last "guess" for the month of July. When "H." can "guess" as well he will be qualified to criticise."

From *Evesham Journal*, July 8th, 1922 :—

> "Mr. W. M. Robertson, of The Longacre, Cheltenham, sent the following rough forecast for July,—'Very variable and unsettled with heavy rain at times, next change 11th to 13th and 25th to 27th, bad weather probably between 3rd and 7th and after next change. Any shift of wind to eastward is nearly certain to be followed by very severe thunderstorms. At the end of the month and beginning of August I anticipate a very bad time. After 7th to 9th August improving prospects for the harvest.'
>
> "This forecast was written on July 3rd, and on July 6th Mr. Robertson wrote :—'The same forecast holds good, with the exception that a strong thundery tendency will prevail during the week end, and these storms will probably be of a tidal nature and affect certain areas much more than others.'"

I should like to add that all or nearly all my Forecasts go to Dundee, Yorkshire, Evesham and Tunbridge Wells and are published in papers in those districts. They are therefore still published in Kent and Sussex, so "H's" final "gibe" misses its mark. The period which "H." took for his criticism was "The May Weather Period," always difficult to forecast and generally bad.

May I also mention that in the *Kent and Sussex Courier* for May 12th, 1922, there appeared the following forecast?—

> "The general outlook for the summer is mostly fine and warm in June; rather wet and unsettled throughout July and the early part of August. Fine harvest weather after the middle of August."

W. M. ROBERTSON.

July, 1922.

Earwigs and Recording Instruments.

CAN any of your readers suggest a way of keeping earwigs out of recording instruments? They have proved very troublesome for some weeks—the clocks of the anemometer and the hyetograph have each been stopped twice, the float rod of the hyetograph has stuck, the pen has been overbalanced and fallen off the chart—all owing to earwigs. Moreover, they crawl from the anemometer pens on to the chart carrying a quantity of ink with them. I have tried Keating's powder, eucalyptus oil, and naphtheline balls, but the trouble is not completely overcome.

C. J. P. CAVE.

Stoner Hill, Petersfield, August 19th, 1922.

NOTES AND QUERIES.

Climatological Stations in Scotland.

OUR knowledge of the climatology of Scotland has hitherto depended largely on the work of voluntary observers, and the co-operation of such observers will always be welcome. But with the passage of time the domestic or other circumstances of any station inevitably change, and it is nowadays more difficult than formerly to secure continuity. Quite recently three of the oldest and most important of the Scottish climatological stations have come to an end, and it is interesting to note how the resulting situation has been dealt with in each case.

At ARBROATH a climatological station had for long been in operation under the auspices of the local Natural History Society. The work depended entirely on the enthusiasm of two or three individuals, and in 1921 Mr. James Campbell, who had observed for 30 years, found himself unable to continue or to find a successor. It was represented to the Town Council of Arbroath that the securing of an adequate representation of the climate of their area should be regarded as a municipal obligation. The Town Council accepted this point of view, and a new station was organised on an excellent site on the outskirts of the town, with a municipal employé, in this case the Superintendent of Cemeteries, as observer.

At the High School, INVERNESS, observations had been made since 1881, and this station was almost unique in Scotland, strengthened as it was by a small endowment fund provided by the family of the late Arthur Forbes of Culloden. Forbes was one of the most vigorous of the pioneers of meteorology in Scotland, and had maintained an elaborate set of observations at Culloden for some fifteen years before the foundation of the Scottish Meteorological Society in 1856. The Culloden series (1841–1880) and the Inverness series (1881–1910) may be regarded as practically homogeneous, as the two places are only about three miles apart and in the same climatic zone. For many years the work at the High School was of a high standard, but latterly increasing difficulty was experienced in making arrangements during vacations, and observations were discontinued at the end of 1921. In this case also the Town Council accepted responsibility, jointly with the Forbes Meteorological Trust, and a new station was established on municipal property two miles to the south of Inverness with the Sanitary Inspector as observer.

The closing of the GLENCARRON station about four months ago was a serious matter from the point of view of Official Meteorology

as it served as District Value station and provided our only source of information regarding a large and most interesting area. The Glencarron estate constitutes a large deer forest in a thinly populated part of West Ross-shire, and observations were made from 1884 onwards, first by D. Munro and then by D. D. Munro, head stalkers on the estate. Recently the property changed hands and observations were discontinued. The problem of replacing Glencarron might have remained unsolved, had not the Forestry Commission (Scotland) happened to have an afforestation area at ACHNASHELLACH, about two miles to the west. Arrangements have now been completed for a station at that place, with the District Forester as observer.

The action in each of these three cases has been taken in pursuance of the definite policy of transferring the responsibility for a station to some public authority. The prospects of continuity are thus greatly increased, and other changes on these lines are under consideration. Again, in order to secure uniformity in observing and a high standard of work the person appointed as observer at each of the three stations noted above attended at either Eskdalemuir or Aberdeen Observatory for a short course of training. This is a new departure, and a similar arrangement was made in the case of the recently opened "Health Resort" station at NORTH BERWICK.

At both Achnashellach and Inverness the observing hours will be 9h. and 18h. It will probably be found impossible in other cases also to insist on the less convenient times (9h. and 21h.) hitherto usual at a Second Order station.

Meteorological and Wireless Station for Greenland.

At a meeting of members of the International Meteorological Committee, held in London in July 1919, the importance of obtaining meteorological information from Greenland for use in daily weather forecasting was emphasised, and it was agreed that the views of the members should be communicated to the Danish Government.

At subsequent meetings of the Commission for Weather Telegraphy, the importance was urged of establishing a wireless station in the South of Greenland, even if it were only powerful enough to communicate with Ireland and not direct with the Continent of Europe.

It is now understood that an expert, sent by the Danish Government, left for Greenland early in August in order to study the local conditions, so that the Government may be in a position to come to a definite decision on the question of establishing a meteorological and wireless station in Southern Greenland.

Upper Air Reports from Egypt.

ARRANGEMENTS have recently been made by which aeroplane flights are carried out daily by the Royal Air Force in Egypt for the purpose of obtaining records of upper air temperature and humidity in that country. These flights are made at Ismaliah in Lower Egypt and the results are cabled to this country by the Meteorological Service of Egypt with the daily report from Cairo.

As little information concerning upper air temperature has formerly been available from Egypt, these observations are of considerable interest.

As with the observations in England the system adopted is to report the temperatures corresponding with specified pressures. The heights can be worked out if required. The fallacy of using an altimeter graduated for some conventional temperature is avoided.

The following report summarising the results obtained in May last has been prepared by Mr. E. V. Newnham.

Note on the Upper Air Reports from Egypt for May, 1922.

By E. V. Newnham, B.Sc.

The observations discussed are those made between April 30th and May 26th.

During the month of May the mean temperature differed very little from the normal at the surface over Egypt and the northern part of the Sudan. The means for temperature in the free atmosphere given in the following table (based on observations for sixteen days) may, therefore be, assumed to represent normal conditions to a first approximation:—

TABLE I.—MEAN VALUE of TEMPERATURE and RELATIVE HUMIDITY for MAY.

Pressure (millibars).	1,014	1,000	950	900	850	800	750	700	650
Approximate height (ft.)	Surface.	400	1,840	3,340	4,900	6,520	8,200	9,920	11,700
Temperature (°F.)	75	72	68	65	61	57	50	42	34
Difference from Normal for May in England (° F.).	—	—	21	22	23	24	22	19	17
Humidity (per cent.)	—	62	60	45	33	36	36	42	52

It will be noticed that the mean temperature was fully 20° higher than the normal for England for this month, except at the two lowest pressures, where the difference was smaller. Relative humidity was very low from 850 to 750 millibars, but was much higher at 650 millibars. In order to make it possible to survey at a glance the variations in temperature from day to day, isopleths have been drawn (*see* fig. 1). The following discussion is partly based on information obtained from the *Egyptian Daily Weather Reports*, in which the upper winds are given for Helwan, and partly on the working charts made in the Meteorological Office in London. At the beginning of the period, on April 30th and May 1st, moderate temperatures* were experienced; much warmer conditions, however, had developed by May 2nd, and this warmth reached a maximum on the 4th at pressures between 1,000 and 850 millibars, and on the 5th at 800 and 750 millibars. The temperature changed very little at pressures of 700 and 650 millibars, and indeed during the whole month the variations at these pressures were small. Examination of the charts for an explanation of this hot spell showed that there was a depression over the Eastern Mediterranean on the 3rd, which was over the Delta and Palestine on the 4th, with S to SW wind up to 16,000 feet on these days. Observations of upper wind are lacking for the 5th, but on the 6th the wind was northerly up to 3,300 feet, backing to SW higher up. It had become north-easterly up to 6,600 feet by the 7th. It would seem, therefore, as though the passage of this depression was the cause of a considerable outflow of hot air from the desert, and that this outflow continued for two days afterwards at heights above 3,300 feet.

A prolonged cool period now set in, at the same time that pressure became high over Central Europe. Between the 9th and the 11th much polar air spread southwards behind a deep depression over Finland, and it is not surprising that on 13th and 14th temperature was low at all pressures at Ismaliah.

On the 13th a depression had appeared over the western part of the Mediterranean, and continued there for three days, causing southerly winds over the central part of the Mediterranean. One is tempted at first to refer the considerable rise of temperature that took place at all pressures at Ismaliah between the 14th and 15th to this northward flow of hot

* A well-developed depression had persisted over the western part of the Mediterranean from the 28th to the 30th of April, causing a considerable flow of air northwards from Africa. Study of the synoptic charts for this period suggests that the air crossing Egypt from NE on the 30th of April and 1st of May seems to have been part of this equatorial air, which must, therefore, have undergone rapid cooling in crossing the Mediterranean.

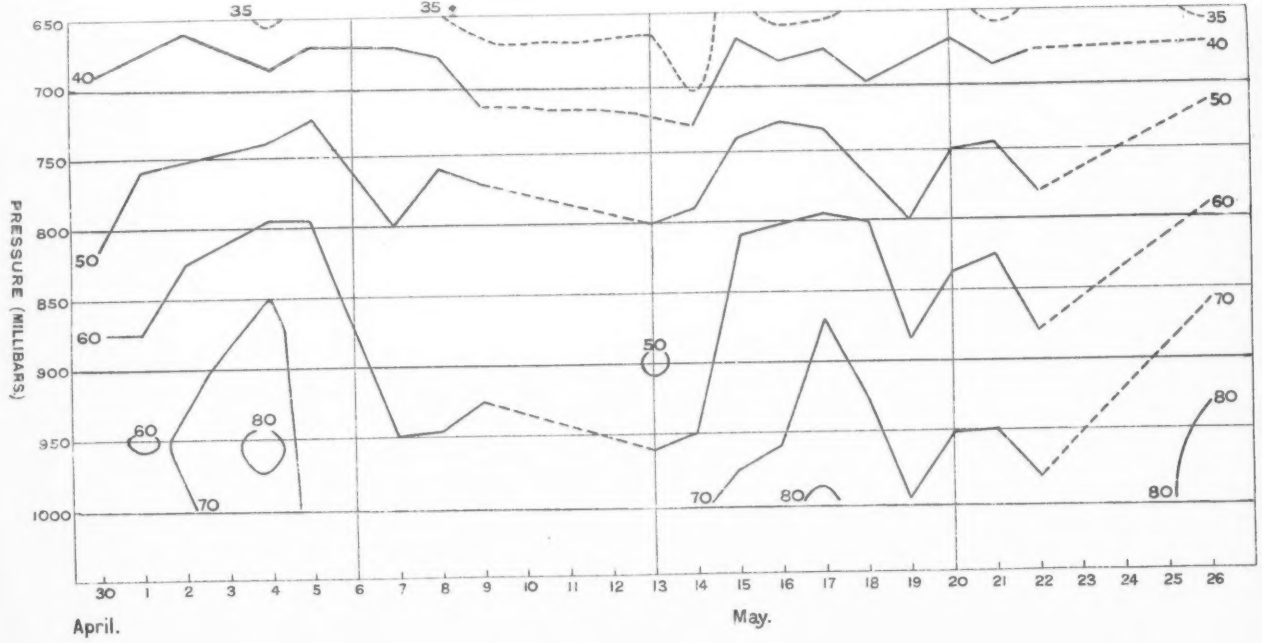


Fig. 1. ISOPLETHS OF TEMPERATURE & PRESSURE FOR ISMALIAH, APRIL 30 TO MAY 26.

equatorial air, but a small anticlcyone centred just north of the Egyptian coast maintained north-easterly to easterly upper winds from the 13th to the 16th, southerly winds appearing only on the 17th. It would seem more probable that the normal N to NW winds were interfered with for a time, and that the heat was due to their absence rather than to an actual flow of air from the south. On the following day (the 18th) northerly winds prevailed up to 16,000 feet at least, and the temperature aloft declined to a sharp minimum on the 19th.

From the 19th to the 22nd the distribution of pressure favoured northerly winds over the Mediterranean as a whole, an anticyclone persisting over France and depressions eastward and southward of Egypt. Upper winds were northerly or northwesterly at Helwan, but the temperature, partly no doubt as a result of the normal seasonal increase at this time of the year, was rather higher than during somewhat similar local conditions earlier in the month, but also perhaps because there was nothing comparable with the southward flow of polar air that took place over Europe between the 9th and 11th.

Additional observations were made on the 26th, and showed temperatures comparable with those observed during the two previous hot spells. By this time the simple northerly type had broken down, and for the two previous days upper winds had been between south and west. For some days pressure had been falling to the west of Egypt, and an irregular system of low pressure had occupied the whole area from the coast down to the Sudan. Here again, as on the 15th, absence of northwesterly winds and comparative stagnation in the upper air gave rise to high temperature, but the distribution of pressure was dissimilar in the two cases.

The summary of the weather for May issued as a supplement to the *Egyptian Daily Weather Report* notes that the weather was of a settled nature with an absence of Khamsîn winds. It is to be presumed, therefore, that the month of May would often give higher temperatures in the upper air than those observed on this occasion. Whether, on the other hand, one would often encounter a distribution of pressure over Europe more favourable for low temperatures in Egypt than that which set in on the 9th, appears more doubtful.

Weather Reports from Amundsen's Expedition.

FROM October 15th the observations taken on board Amundsen's ship the *Maud* will be included in the collective message broadcasted by wireless from the Eiffel Tower daily at 11h. 30m. G.M.T. These reports from the *Maud* will be similar to the American reports noted in the July issue but they will include, in addition, the ship's position.

Zone Time.

IT is well-known that local time differs in different parts of the globe owing to the rotation of the earth about its axis in 24 hours. As the surface is divided into 360 degrees of longitude there will be a difference of one hour between places 15° apart. Formerly there was no systematic treatment of time measurement, all places keeping their own local time. With the increasing importance of time in daily life and particularly with the advent of railways, the disadvantage of this method became obvious, and a practice arose on the part of the railways of using the time of some central or important city on the line for all places not too distant from it. In countries which did not extend too greatly in longitude it was natural to use the time of the capitals throughout all or a large part of their extent. Greenwich being the national time-keeping observatory of Great Britain, as well as the point from which longitudes all over the world were usually reckoned, Greenwich time was selected as our standard. Inconvenience was still felt in passing from one country to another and in making long journeys across extensive countries such as the United States.

The idea of zone time originated with Dowd, of Saratoga, in 1870. Thirteen years later, four time-zones were established in North America, differing by five, six, seven and eight hours respectively from Greenwich Mean Time. The conception of zone time is two-fold. It is a uniform time over a region corresponding approximately to 15° of longitude and it differs from Greenwich Mean Time by an integral number of hours (in a few cases half-hours). The system has been gradually extended, and, with the exception of Russia, the Argentine and a large part of Asia, the regions which have not adopted zone time, based on their longitude, are very restricted. It is proposed in this magazine to note future alterations in this respect as they occur. The most recent changes are (1) Cyprus, for which zone time 2 hours in advance of Greenwich was adopted on November 14th, 1921. The time previously used was 2h. 12m. fast. (2) Nauru, Pleasant Isles, for which zone time 11h. in advance of Greenwich was adopted on August 22nd, 1921. The time previously used was 11h. 8m. fast.

Twin Hurricanes in the Atlantic.

In September, 1921, between the 7th and 15th, two hurricanes traversed the region between Trinidad and Bermuda. The centres of the two depressions kept about 800 miles apart for some days.

A discussion of the observations by Commander L. A. Brooke Smith, R.N.R., Marine Superintendent, is given on the back of the Meteorological Chart of the North Atlantic, September, 1922.

Heavy Rain at Alverstoke, Hants.

AN account of a heavy fall of rain at Alverstoke on August 11th, 1922, has been received from Major J. Blake. He writes that the day was cloudy and murky, with light variable winds. A rather heavy shower (about ·15 in.) fell between 10 and 11 a.m. About 1 p.m. heavy, soft clouds spread in from westward and very heavy rain fell from 1.20 to 2.10 p.m., being exceptionally heavy between 1.30 and 2 p.m. The severity of the fall may be gathered from the fact that the rain poured off a flat verandah roof (about 4 ft. 6 ins. from the ground) and rushed down the path with sufficient force to deposit a heap of gravel, a foot high, on the lawn. Lawns were flooded to a depth of one or two inches and in the walled garden most of the fine soil was washed off the beds.

The reading of the rain gauge was 1·86 in., and for the 24h. ending 9 a.m. on the 12th, 1·88 in. A gauge about 250 yards to the north-west recorded 2·10 in. and 2·12 in. for the 24h.

The storm which seemed to travel out to sea appears to have been very local, places only a mile or two to the north and north-west having much less heavy rain. The *Daily Weather Report* for August 12th reports only 10 mm. (·39 in.) at Portsmouth, 2½ miles north-east of Alverstoke and only a " trace " at Calshot, 9 miles to the north-west.

Major Blake has also sent a cutting from the yachting notes in the *Field* of August 19th which confirms his observation that the storm went out to sea.

> " Towards the end of the race off Spithead, out of a dense black cloud northerly there came a sudden squall of rain, and a good deal of wind with it; the rain was blinding, and ran off the mainsails of the yachts in torrents . . . the sea smooth, beaten down by the rain in the fury of the squall . . . but it was soon gone, leaving us lolling in a paltry calm, the sails too water-logged to catch the breeze "

Compensation for a Wet Holiday.

THE *Daily News* has inaugurated a scheme of compensating for a wet holiday. During the first two weeks of August £500 per week was to-be allocated to the 330 readers who suffered most on their holidays from heavy rainfall. The payments were to be based on the measurements recorded at the nearest town given in the official list of the Meteorological Office or on well authenticated local records of rainfall which the editor could accept as accurate. The rules do not appear to have been drawn up with any regard to the hours at which rainfall is nominally measured and arbitration on the claims of various readers must have presented considerable difficulty.

Radiation from the Sky.

RADIATION MEASURED AT BENSON, OXON, 1922.

Unit : one gramme calorie per square centimetre per day.

ATMOSPHERIC RADIATION only (dark heat rays).

Averages for Readings about time of Sunset.

		April.	May.	June.
Cloudless days :—				
Number of readings	n	15	25	18
Radiation from sky in zenith	πI	439	530	555
Total radiation from sky	J	477	568	592
Total radiation from horizontal black surface on earth.	X	705	767	798
Net radiation from earth	X–J	228	199	206

DIFFUSE SOLAR RADIATION (luminous rays).

Averages for Readings between 9 h. and 15 h. G.M.T.

Cloudless days :—				
Number of readings	n_0	7	9	6
Radiation from sky in zenith	πI_0	23	37	37
Total radiation from sky	J_0	32	39	34
Cloudy days :—				
Number of readings	n_1	8	9	10
Radiation from sky in zenith	πI_1	620	688	736
Total radiation from sky	J_1	643	705	737

Unit for I = gramme calorie per day per steradian per square centimetre.

Unit for J and X = gramme calorie per day per square centimetre.

For description of instrument and methods of observation, see *The Meteorological Magazine*, October, 1920, and May, 1921.

Norwegian Daily Weather Reports.

FROM January 1st, 1922, a new series of charts has been issued by the Bergen Division of the Norwegian Meteorological Institute. The charts, which are issued twice a day, at 8h. and 19h., are synoptic weather maps drawn in accordance with Professor Bjerknes' theories and show the "warm fronts," "cold fronts" and "occluded fronts" found by analysis of the observations. The affixed text gives information about the situation and the features upon which the analysis has been based.

Reviews.

Deux Théorèmes Fondamentaux de la Dynamique de la Mer. Traité élémentaire experimental. By J. W. Sandström. Ur Svenska Hydrografisk-Biologiska Kommissionens Skrifter, VI. Stockholm, 1921. 18 × 12½. pp. 6, *illus.*

HYDROGRAPHICAL observations show that the behaviour of stratified masses of water such as the sea, under the influence of exterior forces due to the wind or the earth's rotation, is such that an interchange of particles between strata of different density, *i.e.*, mixing of the strata, takes place so slowly that it may be disregarded over long periods so that, for instance, discontinuities once in existence persist for a long time. On the other hand, should any cause, such as the addition or abstraction of heat or the fusion of ice, operate to produce a change of density at any point then the stratification is upset, the affected water seeking a fresh stratum corresponding to its new density. These results are embodied by the author in two theorems enunciated at the beginning of the present publication, which is then devoted to a description of experiments, carried out on a laboratory scale, in illustration of them, and to the application of the principles to a number of cases in nature.

One of the experiments shows, for example, how, in a fluid with several strata of finite thickness, the wind sets up a circulation about a horizontal axis which is limited to the uppermost stratum, while an opposite circulation may be imparted to the adjacent stratum by friction at the interface, and so on. The junctions between the strata become inclined and the motion set up is much more complicated than in a homogeneous fluid.

Other interesting experiments demonstrate the currents set up by the melting of ice floating in water and also by a source of heat and a source of cold placed in various relative positions, and the significance of these is discussed in connection with the maintenance of large ocean currents, such as the Gulf Stream, the causes of which lie in physical changes in the condition of the water.

One point of practical importance may be cited. It is shown how the homogeneity of the waters of the Labrador current permits of the superimposition of a marked circulation about a horizontal axis giving the surface waters a strong component towards the rocky east and south coasts of Newfoundland, and this, combined with low visibility due to fog, is responsible for frequent shipwrecks in those regions.

As the title indicates, the treatment is elementary, but the paper, which is amply illustrated by diagrams, is very interesting reading. M. A. G.

Rio de Janeiro, Ministerio da Agricultura, Industria e Commercio ; Directoria de Meteorologia. Boletin de Normals. Observacões meteorologicas feitas no ex-Observatorio Nacional hoje Instituto Central do Rio de Janeiro, e nas Estacões da rêde Nacional. 1922. 4°. pp. viii. + 66.

AMONG the first fruits of the reorganisation of the Brazilian Meteorological Service under the energetic leadership of Señor Sampaio Ferraz (see this Magazine, 1921, pp. 225, 334) we welcome the publication of a collection of normal climatological values for Rio de Janeiro and for a large number of stations of the second and third order, besides rainfall stations. For Rio de Janeiro the monthly figures are given year by year for all elements from the beginning of reliable observations, in most cases 1890, until 1920, with daily normals of temperature and rainfall from 1882. For the provincial stations the normals cover periods ranging from five to twenty-four years ending in 1919 and include all elements, with remarkably complete series of phenomena. The great majority of these stations were established by the old Directoria de Meteorologia e Astronomia between 1909 and 1914, and the observations are all on a uniform system, with one curious exception, which refers to the thermometer screens. At the second order stations the type of screen is similar to that in use in Mexico (two louvred screens one within the other, surmounted by an overhanging gable top)* but smaller and better ventilated, while stations of the third order employ a large type of Stevenson screen. Tests carried out with the aid of an aspirated thermometer show that the former screen gives retarded and exaggerated maxima and the daily mean temperature at second order stations has therefore been calculated from the formula $\frac{1}{4}(7hr + 14hr + 2 \times 21hr.)$, while at third order stations the formula $\frac{1}{4}(7hr + 21hr. + \text{Max.} + \text{Min.})$ has been used. It is also stated that the rain gauges are usually placed on high pillars, and the quantity of rain registered is therefore too small.

As the first extensive series of normals from Brazil, this publication will be of very great value to meteorologists. It appears to have been prepared with great care and becomes at once the standard source of information as to the climate of Brazil. Incidentally, the list of errata is at the end, and should be consulted before the figures are utilised.

May we hope, moreover, that when time permits Señor Sampaio Ferraz will utilise his own knowledge of local conditions in interpreting the figures for us by means of a series of charts to supplement the present volume?

---

* See *Rio de Janeiro, Ministerio da Agricultura. Instrucções meteorologicas, por J. de Sampaio Ferraz.* 1914. Vol. 1, p. 70.

News in Brief.

WE regret to announce the death, on September 3rd, of Mr. Leslie Stuart Priestley, Junior Professional Assistant of the Meteorological Office, stationed at Shoeburyness.

A PAPER on "Germany's Climate" will be read by Dr. Sven Hedin at the Centennial Festival of the Gesellschaft Deutscher Naturforscher und Artze, September 18th–24th, 1922.

NEWS is received that the sunshine record from Birr Castle has been interrupted. Rebel forces were sniping from the top of the Rosse telescope, and the necessary removal of the stairs has rendered the recorder inaccessible for the present.

Errata.

June 1922, page 192, line 19, "our Celtic spring begins on February 2nd" *should read* "the old Celtic spring began on February 2nd."

August 1922, page 186, paragraph 4, line 6, *for* "$-0\cdot34$" *read* "$-0\cdot35$," *and for* "$\pm0\cdot57$" *read* "$\pm0\cdot58$."

August 1922, page 202, paragraph 6, line 4, *for* "100 mm. (2 in.)" *read* "100 mm. (4 in.)."

The Weather of August, 1922.

August, like the preceding month, proved to be cool and unsettled in north-west Europe. At the beginning of the month there was a depression between Iceland and the Faröe Islands, while an extensive anticyclone stretched from the Azores to France. On the 1st, local disturbances caused heavy rain and thunderstorms in Switzerland, Berne recording 46 mm. of rain in the 24 hours. The Icelandic depression moved north-eastward and the Azores anticyclone eastward. By the 4th the latter was over Central Europe and pressure had become high in Iceland, with the result that the Atlantic depressions took a more southerly course.

On the 6th a depression appeared over the mouth of the English Channel and moved north-eastward across England. This was followed by the appearance of a second disturbance off the south-west coasts, which also moved north-eastward and joined up with the first centre over the North Sea. These disturbances caused thunderstorms and notably heavy rain in England, particularly in the Midlands and the North, where extensive floods caused much damage. More than 50 mm. (2 inches) appears

to have fallen on the 6th over a strip extending from Swanage to Worksop, and on the 7th in the south of Yorkshire. Between midnight and 16 h. on August 7th no less than 99·5 mm. (3·92 in.) of rain fell at Sheffield, which, with a further 8 mm. (·32 in.) between 16 h. on the 7th and 3 h. on the 8th, gave a total of 107·5 mm. (4·24 in.) in 27 hours. At Strelley Hall, Nottinghamshire, 82 mm. (3·23 in.) of rain was measured in 21 hours, while Harrogate had 123 mm. (4·84 in.) in three days. At Hodsock Priory, near Worksop, rain commenced at 23 h. on August 6th and ceased at 3 h. on the 8th, 125 mm. (5·06 in.) falling in this period. From 9 h. to 11 h. 15 m. on 7th 50 mm. (1·97 in.) fell.

As these disturbances moved eastward, a ridge of high pressure spread in over the British Isles from the Atlantic, and by the 11th this was stretching from the Azores to Spitzbergen. This split up into two " highs," one over the Spitzbergen region and one over the Azores. A new depression appeared in the vicinity of Iceland and moved eastward, keeping north of the British Isles. This type of distribution continued for some days with depressions passing to the north of Britain and maintaining generally unsettled weather in north-west Europe.

On the 14th, a shallow area of low pressure over France moved eastward and caused heavy rains and thunderstorms locally, Frankfurt measuring 71 mm. in 24 hours. About this time high temperatures were registered in the south of France, Toulouse reaching 95° F. on the 13th and Lyons 93° F. on the 14th. Conditions in western and central Europe now became more settled under the influence of a " high " over Germany and an eastward extension of the Azores anticyclone. On the 21st the maximum temperature at Bayonne reached 101° F.

On the 22nd a depression over Iceland moved in a south-easterly direction, and by the 23rd was over Denmark, causing a renewal of very unsettled conditions over west and north-west Europe. Rainfall was very heavy in parts of Germany, Scandinavia and Denmark. This system moved north and filled up, but further depressions advanced from the Atlantic, and by the 28th a trough of low pressure stretched from Iceland to Spain, and, spreading further eastward, maintained unsettled weather to the end of the month. On the 30th a small secondary disturbance caused 79 mm. of rain at Berne. W. C. K.

A violent thunderstorm occurred over the neighbourhood of Lyons on the 7th. A large part of the town was plunged in darkness by the destruction of the Jonage Electric Works by lightning. As nearly all the local factories depended on these works for power and light, hundreds of persons were thrown out of employment.

At the middle of the month, southern France experienced a spell of hot weather, and a shade temperature of 98·6° F. was

registered at Toulon. Many forest fires broke out, thousands of acres of woodland being involved. Between the 14th and 16th violent hailstorms occurred in the Meuse and Saône-et-Loire Departments, followed by an extremely severe one in the Charolle district (Saône-et-Loire), in the course of which cattle were killed and many large trees uprooted.

On the 2nd, hailstorms were experienced over wide areas of Switzerland, much damage being caused in the Cantons of Vaud, Berne and Appenzell.

Two ships were lost near Gibraltar during a dense fog which covered the Straits on the morning of the 6th.

After the first week of August very hot weather was experienced in Italy, associated with high pressures over central or eastern Europe. In Rome and in the Umbrian Hills the shade temperature frequently exceeded 100° F.; on the 12th 112° F. is said to have been registered at Foggia, near Bari, on the Adriatic, the highest temperature known in Italy for the past half-century. Exceptional heat was also felt in other Mediterranean countries and forest fires broke out in southern France, Algeria, Sardinia, Greece.

A pronounced break occurred in the Indian monsoon and the first half of the month was almost rainless in central and north-west India and the northern Deccan. Certain regions, however, had normal and even excess rainfall, the latter occurring mainly on the Madras coast and in Bengal and Burma. On the 9th extensive floods were reported from Rangoon, involving the temporary cutting off of Upper from Lower Burma, and on the 14th over one hundred square miles of the Midnapore district of Bengal were inundated. Heavy rain also fell in Waziristan (eastern Afghanistan). One storm occurred in the Bay of Bengal.

Further details are available of the great typhoon which wrecked Swatow, on the Han River delta in southern China, on the 2nd, and which was briefly reported in last month's issue. The loss of life in the delta, which contain many populous towns, is now estimated as at least 50,000. There were two typhoons, of which the second was the more severe, being accompanied by thunder, torrential rain and a large tidal wave which carried everything before it. The wind reached a velocity of over 100 miles per hour. All shipping was wrecked and one motor-boat was found five miles inland. Apart from the severity of the typhoon, its early date was a noticeable feature, the season not usually beginning on this part of the coast until the end of August.

The hot weather experienced in Japan and in the hinterland of northern China during July continued in August. Daily shade temperatures frequently exceeded 100° F. and on several occasions

(*Continued on p.* 230.)

Rainfall Table for August 1922.

STATION.	COUNTY.	Aver. 1881–1915.	1922.		Per cent. of Av.	Max. in 24 hrs.		No. of Rain Days
		in.	in.	mm.		in.	Date.	
Camden Square	*London*	2·21	2·54	65	115	·55	6	17
Tenterden (View Tower)	*Kent*	2·29	2·27	58	99	·57	9	19
Arundel (Patching Farm)	*Sussex*	2·52	2·46	63	98	·43	6	14
Fordingbridge (Oaklands)	*Hampshire*	2·63	5·81	148	221	2·38	6	20
Oxford (Magdalen College)	*Oxfordshire*	2·25	5·11	130	227	2·82	6	16
Wellingborough (Swanspool)	*Northampton*	2·38	5·32	135	224	3·05	6	19
Hawkedon Rectory	*Suffolk*	2·59	2·06	52	80	·37	7	16
Norwich (Eaton)	*Norfolk*	2·37	1·54	39	65	·35	3	17
Launceston (Polapit Tamar)	*Devon*	3·18	3·08	78	97	·73	8	22
Sidmouth (Sidmount)	"	2·81	3·77	96	134	1·37	6	17
Ross (County Observatory)	*Herefordshire*	2·56	2·76	70	108	·54	7	17
Church Stretton (Wolstaston)	*Shropshire*	3·25	2·65	67	82	·49	12	17
Boston (Black Sluice)	*Lincoln*	2·39	1·81	46	76	·30	6	15
Worksop (Hodsock Priory)	*Nottingham*	2·45	6·50	165	276	3·23	7	15
Mickleover (Clyde House)	*Derbyshire*	2·72	5·66	144	208	1·97	6	15
Southport (Hesketh Park)	*Lancashire*	3·48	5·94	151	155	2·56	31	20
Wetherby (Ribston Hall)	*York, W. R.*	2·73	6·65	169	244	2·45	7	9
Hull (Pearson Park)	" *E. R.*	2·91	3·19	81	110	1·11	7	13
Newcastle (Town Moor)	*North'land*	2·92	2·62	67	90	·96	8	14
Borrowdale (Seathwaite)	*Cumberland*	11·57	10·00	254	86	..	..	..
Cardiff (Ely Pumping Stn.)	*Glamorgan*	4·32	4·16	106	96	·68	12	22
Haverfordwest (Gram. Sch.)	*Pembroke*	4·17	5·36	136	129	1·04	8	15
Aberystwyth (Gogerddan)	*Cardigan*	4·87	5·21	132	107	1·29	8	9
Llandudno	*Carnarvon*	3·02	1·45	37	48	·21	12	13
Dumfries (Cargen)	*Kirkcudbrt.*	4·40	3·15	80	72	·35	8	20
Marchmont House	*Berwick*	3·31	2·73	69	82	1·27	8	15
Girvan (Pinmore)	*Ayr*	4·45	2·89	73	65	·36	31	23
Glasgow (Queen's Park)	*Renfrew*	3·54	2·56	65	72	·52	8	22
Islay (Eallabus)	*Argyll*	4·36	5·29	134	121	1·15	26	21
Mull (Quinish)	"	4·91	4·18	106	85	1·00	15	23
Loch Dhu	*Perth*	6·75	5·35	136	79	1·10	6	16
Dundee (Eastern Necropolis)	*Forfar*	3·38	2·96	75	88	1·12	2	17
Braemar (Bank)	*Aberdeen*	3·41	2·82	72	83	·44	22	17
Aberdeen (Cranford)	"	2·88	2·51	64	87	·36	1, 15	22
Gordon Castle	*Moray*	3·17	2·78	71	88	·57	22	16
Fort William (Atholl Bank)	*Inverness*	6·16	4·63	118	75	·96	15	22
Alness (Ardross Castle)	*Ross*	2·95	2·16	55	73	·78	22	18
Loch Torridon (Bendamph)	"	6·60	4·51	115	68	1·03	22	21
Stornoway	"	3·97	4·61	117	116	·74	22	21
Loch More (Achfary)	*Sutherland*	5·84	5·58	142	96	1·21	15	24
Wick	*Caithness*	2·75	2·05	52	74	·39	17	19
Glanmire (Lota Lodge)	*Cork*	3·65	5·02	127	138	1·73	3	18
Killarney (District Asylum)	*Kerry*	4·42	..	..	..	..	..	..
Waterford (Brook Lodge)	*Waterford*	3·83	4·76	121	124	·92	3	19
Nenagh (Castle Lough)	*Tipperary*	3·95	..	..	..	..	..	..
Foynes	*Limerick*	3·86	2·76	70	72	·33	29	28
Gorey (Courtown House)	*Wexford*	3·33	..	..	..	..	..	..
Abbey Leix (Blandsfort)	*Queen's Co.*	3·95	3·49	89	88	·75	29	21
Dublin (FitzWilliam Square)	*Dublin*	3·04	4·23	107	139	1·84	30	19
Mullingar (Belvedere)	*Westmeath*	4·17	5·52	140	132	1·23	4	27
Crossmolina (Enniscoe)	*Mayo*	4·51	..	..	..	..	..	..
Collooney (Markree Obsy.)	*Sligo*	4·35	3·76	95	86	·50	11	24
Seaforde	*Down*	3·75	3·85	98	103	·53	20	19
Ballymena (Harryville)	*Antrim*	4·27	3·80	97	89	·66	29	22
Omagh (Edenfel)	*Tyrone*	4·27	4·49	114	105	1·24	30	21
Letterkenny Asylum	*Donegal*	4·50	3·04	77	68	·47	30	21

Stornoway for July should read 2·56 in., 65 mm.

Supplementary Rainfall, August 1922.

Div.	STATION.	RAIN.		Div.	STATION.	RAIN.	
		in.	mm.			in.	mm.
II.	Ramsgate	..	..	XII.	Langholm, Drove Rd.	5·43	138
,,	Sevenoaks, Speldhurst	2·85	72	XIII.	Ettrick Manse	3·75	95
,,	Hailsham Vicarage...	3·55	90	,,	North Berwick Res. ...	1·44	37
,,	Totland Bay, Aston Ho.	2·51	64	,,	Edinburgh, Royal Ob.	1·46	37
,,	Ashley, Old Manor Ho.	3·30	84	XIV.	Biggar.....	2·52	64
,,	Grayshott.....	3·28	83	,,	Leadhills	5·57	141
,,	Ufton Nervet.....	4·20	107	,,	Kilmarnock, Agric.Coll.	3·99	101
III.	Harrow Weald, Hill Ho.	2·91	74	XV.	Dougarie Lodge.....	3·43	87
,,	Pitsford, Sedgebrook..	4·99	127	,,	Oban.....	3·57	91
,,	Chatteris, The Priory.	1·51	38	,,	Holy Loch, Ardnadam	5·43	138
IV.	Elsenham, Gaunts End	2·77	70	,,	Tiree, Cornaigmore....	..	..
,,	Lexden, Hill House ..	·97	25	XVI.	Loch Venachar	3·25	83
,,	Aylsham, Rippon Hall	1·58	40	,,	Glenquey Reservoir ...	4·10	104
,,	Swaffham.....	2·24	57	,,	Loch Rannoch, Dall...	1·60	41
V.	Devizes, Highclere ...	3·87	98	,,	Blair Atholl.....	2·23	57
,,	Weymouth.....	2·96	75	,,	Coupar Angus.....	2·07	53
,,	Ashburton, Druid Ho.	4·78	121	,,	Montrose Asylum	1·85	47
,,	Cullompton	4·42	112	XVII.	Logie Coldstone, School	2·50	63
,,	Hartland Abbey	3·20	81	,,	Fyvie Castle.....	2·27	58
,,	Penzance, Morrab Gden.	4·01	102	,,	Grantown-on-Spey ...	3·02	77
,,	St. Austell, Trevarna.	3·89	99	XVIII.	Kingussie, Fasnakyle..	..	..
,,	Crewkerne Merefield Ho	4·41	112	,,	Fort Augustus.....	2·80	71
VI.	Clifton College	4·74	120	,,	Loch Quoich, Loan ...	9·20	..
,,	Ledbury, Underdown.	2·59	66	,,	Fortrose	1·91	49
,,	Shifnal, Hatton Grange	2·73	69	,,	Faire-na-Squir.....	..	..
,,	Ashbourne, Mayfield.	5.37	136	,,	Skye, Dunvegan	5·40	137
,,	Barnt Green, Upwood	4·19	106	XIX.	Loch Carron, Plockton.	..	..
,,	Blockley, Upton Wold	5·67	144	,,	Dornoch, St. Gilbert's .	2·13	54
VII.	Leicester, TownHallSq.	4·67	119	,,	Tongue Manse	2·75	70
,,	Grantham, Saltersford	6·12	155	,,	Melvich Schoolhouse ..	3·00	76
,,	Louth, Westgate	2·84	72	XX.	Caheragh Rectory	6·50	165
,,	Mansfield, West Bank	6·30	160	,,	Mitchelstown Castle...	..	..
VIII.	Nantwich, Dorfold Hall	3·34	85	,,	Tipperary, The Vale ..	2·79	71
,,	Bolton, Queen's Park.	5·77	147	,,	Darrynane Abbey	..	..
,,	Lancaster, Strathspey.	5·76	146	,,	Cashel, Ballinamona...	3·39	86
IX.	Wath-upon-Dearne...	..	..	,,	Roscrea, Timoney Park	..	..
,,	Bradford, Lister Park.	5·40	137	,,	Broadford, Hurdlestown	3·32	84
,,	West Witton.....	3·07	78	XXI.	Kilkenny Castle.....	3·86	98
,,	Scarborough, Scalby..	3·83	97	,,	Rathnew, Clonmannon	4·73	120
,,	Middlesbro', Albert Pk.	2·28	58	,,	Hacketstown Rectory .	6·18	157
,,	Mickleton.....	..	..	,,	Balbriggan, Ardgillan .	3·88	99
X.	Bellingham	2·53	64	,,	Drogheda	3·99	101
,,	Ilderton, Lilburn	1·76	45	,,	Athlone, Twyford	..	..
,,	Orton.....	4·86	123	XXII.	Castle Forbes Gdns....	4·50	114
XI.	Llanfrechfa Grange ..	3·47	88	,,	Ballynahinch Castle...	6·31	160
,,	Treherbert, Tyn-y-waun	6·84	174	,,	Galway, Waterdale ...	4·13	105
,,	Carmarthen Friary ..	4·64	118	XXIII.	Westport House	3·97	101
,,	Lampeter, Falcondale	3·58	91	,,	Enniskillen, Portora...	..	..
,,	Cray Station	4·10	104	,,	Crossdoney Kent Cas. .	3·93	100
,,	B'ham W.W., Tyrmyndd	3·56	90	,,	Armagh Observatory ..	3·84	97
,,	Lake Vyrnwy.....	4·13	105	,,	Warrenpoint	4·71	120
,,	Llangynhafal, P. Drâw	3·29	84	,,	Belfast, Cave Hill Rd..	4·35	111
,,	Oakley Quarries	8·72	221	,,	Glenarm Castle	4·64	118
,,	Dolgelly, Bryntirion..	5·25	133	,,	Londonderry, Creggan.	3·68	93
,,	Snowdon, Llydaw 10.	2·33	313	,,	Sion Mills.....	3·77	96
,,	Lligwy	2·82	72	,,	Milford, The Manse ...	3·61	92
XII.	Stoneykirk, Ardwell Ho	3·26	83	,,	Narin, Kiltoorish	3·68	93
,,	Carsphairn, Shiel.....	5·80	147	,,	Killybegs, Rockmount .	4·28	109

Climatological Table for the

STATIONS	PRESSURE		TEMPERATURE							
			Absolute				Mean Values			
	Mean M.S.L.	Diff. from Normal	Max.	Date	Min.	Date	Max.	Min.	½ max. and min.	Diff. from Normal
	mb.	mb.	°F.		°F.		°F.	°F.	°F.	°F.
London, Kew Observatory	1011·8	−2·0	56	3	28	26	46·9	36·7	41·8	−0·2
Gibraltar	1016·6	+0·8	72	6	42	23, 24	63·0	50·5	56·7	−1·3
Malta	1018·5	+4·6	75	23	47	4	64·3	54·5	59·4	+3·2
Sierra Leone	1011·0	+0·1	95	9, 16	73	16, 22	90·8	75·2	83·0	+0·3
Lagos, Nigeria	..	..	..	..	..	..	..	..	..	..
Kaduna, Nigeria	..	..	..	..	..	..	..	..	..	..
Zomba, Nyasaland	1009·8	+0·1	89	18	57	3	82·7	63·3	73·0	+2·3
Salisbury, Rhodesia	1007·8	−3·6	92	19	52	2	85·8	58·4	72·1	+4·0
Cape Town	1014·8	+0·3	100	11	48	22	78·1	59·4	68·7	+0·3
Johannesburg	1013·2	−0·2	82	11	49	1	74·5	54·2	64·3	+1·0
Mauritius	..	..	..	..	..	..	..	..	..	..
Bloemfontein	..	..	93	2	40	23	84·7	55·1	69·9	+2·5
Calcutta, Alipore Obsy.	1008·2	−1·7	101	29	56	9	96·1	70·4	83·3	+3·2
Bombay	1010·4	−0·3	92	8	67	6	87·4	72·8	80·1	+0·6
Madras	..	..	97	15	66	1	91·4	71·9	81·7	+0·7
Colombo, Ceylon	1011·0	+1·0	91	2	67	1	89·3	73·9	81·6	−0·4
Hong Kong	1015·4	−0·4	77	13	53	1	68·5	61·1	64·8	+1·5
Sandakan	..	..	88	24, 25	72	13	85·7	74·9	80·3	−0·8
Sydney	1014·5	−1·7	92	18	51	26	79·1	60·6	69·9	+0·7
Melbourne	1016·0	−1·0	95	18	46	23	73·3	53·6	63·5	−1·0
Adelaide	1017·4	+0·4	100	17	49	25	81·7	56·5	69·1	−0·8
Perth, Western Australia	1013·7	−1·7	106	14	52	27	83·3	61·8	72·5	+1·6
Coolgardie	1013·4	−1·4	105	8	50	22, 23	88·8	60·6	74·7	+3·0
Brisbane	1014·8	+0·7	93	19	60	16	83·9	65·4	74·7	+0·3
Hobart, Tasmania	1010·9	−3·1	86	18	45	27	66·9	50·4	58·7	−0·7
Wellington, N.Z.	1004·4	−12·6	75	9	44	6	67·2	53·2	60·2	−0·5
Suva, Fiji	1008·5	0·0	90	11	69	24	86·9	71·9	79·4	−0·7
Kingston, Jamaica	1015·6	+0·6	89	12	65	2	86·7	67·9	77·3	+0·2
Grenada, W.I.	1014·9	+2·0	87	23, 24	68	11	82·2	71·6	76·9	−0·8
Toronto	1019·2	+2·2	58	14	13	18	41·8	26·7	34·3	+5·4
Winnipeg	1018·0	−0·8	49	13	9	28	33·4	16·0	24·7	+10·3
St. John, N.B.	1015·9	+1·7	54	29	−1	2	38·5	24·0	31·3	+2·9
Victoria, B.C.	1014·4	−1·4	56	29	33	21	48·0	36·7	42·3	−0·9

LONDON, KEW OBSERVATORY.—Prevailing wind direction NE, mean speed 11·1 mi/hr. 6 days with snow, 1 day with hail, 1 day with thunder heard.

GIBRALTAR.—Prevailing wind direction W. 3 days with gale.

MALTA.—Prevailing wind direction westerly. 5 days with hail, 1 day with thunder heard.

SIERRA LEONE.—Prevailing wind direction SW. 6 days with harmattan.

SALISBURY, RHODESIA.—Prevailing wind direction easterly.

COLOMBO, CEYLON.—Prevailing wind direction WSW, mean speed 3·9 mi/hr. Sea breeze by day, light wind at night. 2 days with thunder heard.

British Empire, March 1922.

TEMPERATURE		Relative Humidity	Mean Cloud Am'nt	PRECIPITATION				BRIGHT SUNSHINE		STATIONS
Mean	Absolute			Amount		Diff. from Normal	Days	Hours per day	Percentage of possible	
Wet Bulb. °F.	Min. on Grass °F.	%	0–10	in.	mm.	mm.				
39·2	21	76	7·0	1·69	43	0	15	2·9	25	London, Kew Observatory.
52·3	37	77	4·6	2·81	71	− 51	14	..	..	Gibraltar.
53·9	41	75	4·3	0·38	10	− 25	5	8·4	71	Malta.
73·5	..	61	1·9	0·00	0	− 28	0	..	..	Sierra Leone.
..	..	..	..	..	..	..	..	..	..	Lagos, Nigeria.
..	..	..	..	..	..	..	..	..	..	Kaduna, Nigeria.
..	..	83	5·1	2·01	51	−159	13	..	..	Zomba, Nyasaland.
63·6	..	60	2·0	2·08	53	− 54	6	..	..	Salisbury, Rhodesia.
63·1	..	67	3·5	0·57	14	− 10	3	..	..	Cape Town.
55·7	44	73	5·1	4·96	126	+ 19	15	8·1	66	Johannesburg.
..	..	..	..	..	..	..	..	..	..	Mauritius.
56·6	..	52	1·9	0·11	3	− 98	3	..	..	Bloemfontein.
70·4	45	35	0·6	0·02	1	− 31	0*	..	..	Calcutta, Alipore Obsy.
71·6	55	61	0·6	0·00	0	− 1	0*	..	..	Bombay.
74·4	62	70	0·6	0·00	0	− 5	0*	..	..	Madras.
77·2	62	60	4·6	1·63	41	− 71	5	..	..	Colombo, Ceylon.
60·7	..	81	8·5	3·67	93	+ 17	9	3·1	26	Hong Kong.
76·9	..	85	..	13·32	338	+132	15	..	..	Sandakan.
64·7	41	63	3·4	1·66	42	− 88	6	8·4	68	Sydney.
57·5	39	57	5·0	0·43	11	− 46	5	..	..	Melbourne.
57·4	36	43	3·3	0·13	3	− 23	2	9·0	74	Adelaide.
63·1	43	51	2·9	0·19	5	− 13	4	9·4	76	Perth, Western Australia.
62·9	..	36	2·5	2·67	68	+ 49	4	..	..	Coolgardie.
68·9	58	67	2·9	2·01	51	− 99	10	..	..	Brisbane.
52·1	39	61	5·8	0·65	17	− 26	13	7·0	56	Hobart, Tasmania.
55·3	34	72	6·6	6·81	173	+ 90	15	5·8	47	Wellington, N.Z.
77·5	..	87	6·6	29·52	750	+377	24	..	..	Suva, Fiji.
..	..	73	5·7	0·82	21	− 5	6	..	..	Kingston, Jamaica.
72·0	..	74	4·7	5·16	131	+ 61	21	..	..	Grenada, W.I.
29·5	9	69	4·6	3·06	78	+ 11	14	..	..	Toronto.
23·1	..	92	5·0	1·34	34	+ 7	4	..	..	Winnipeg.
28·4	−1	73	4·9	3·29	84	− 31	10	..	..	St. John, N.B.
38·4	25	81	0·6	1·23	31	− 34	16	..	..	Victoria, B.C.

* For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen.

HONG KONG.—Prevailing wind direction E, mean speed 14·6 mi/hr. 1 day with fog.

SANDAKAN.—Prevailing wind direction NE.

PERTH, W.A.—Prevailing wind direction SSW, mean speed 11·8 mi/hr. Absolute max, record for March.

WELLINGTON, N.Z.—Prevailing wind direction NW.

SUVA, FIJI.—Calms predominate. 6 days with thunder heard.

GRENADA, W.I.—Prevailing wind direction E. 1 day with thunder heard.

(*Continued from p. 225.*)

reached 115° F. in Tientsin and Pekin. The Japanese cruiser *Nitaka* sank in a typhoon off the Kamchatka coast on the 26th.

Transatlantic steamers have reported many icebergs in the North Atlantic, and the Cunard liner *Antonia* was delayed for eighteen hours by fog off the Banks of Newfoundland.

The weather has continued very favourable for the Canadian crops which are expected to exceed the famous results of 1915. Even the Manitoba section, which suffered tremendous damage from hail in June, has recovered. Satisfactory rain fell in British Columbia during the month.

The report of the United States Weather Bureau dated August 9th states that the drought was continuing in the western section of the cotton belt, with intensely hot weather in Oklahoma. Light rains prevailed over most of the central and eastern sections.

On the 4th it was reported that heavy rains had caused extensive floods in Southern Chile with great damage to property and agriculture.

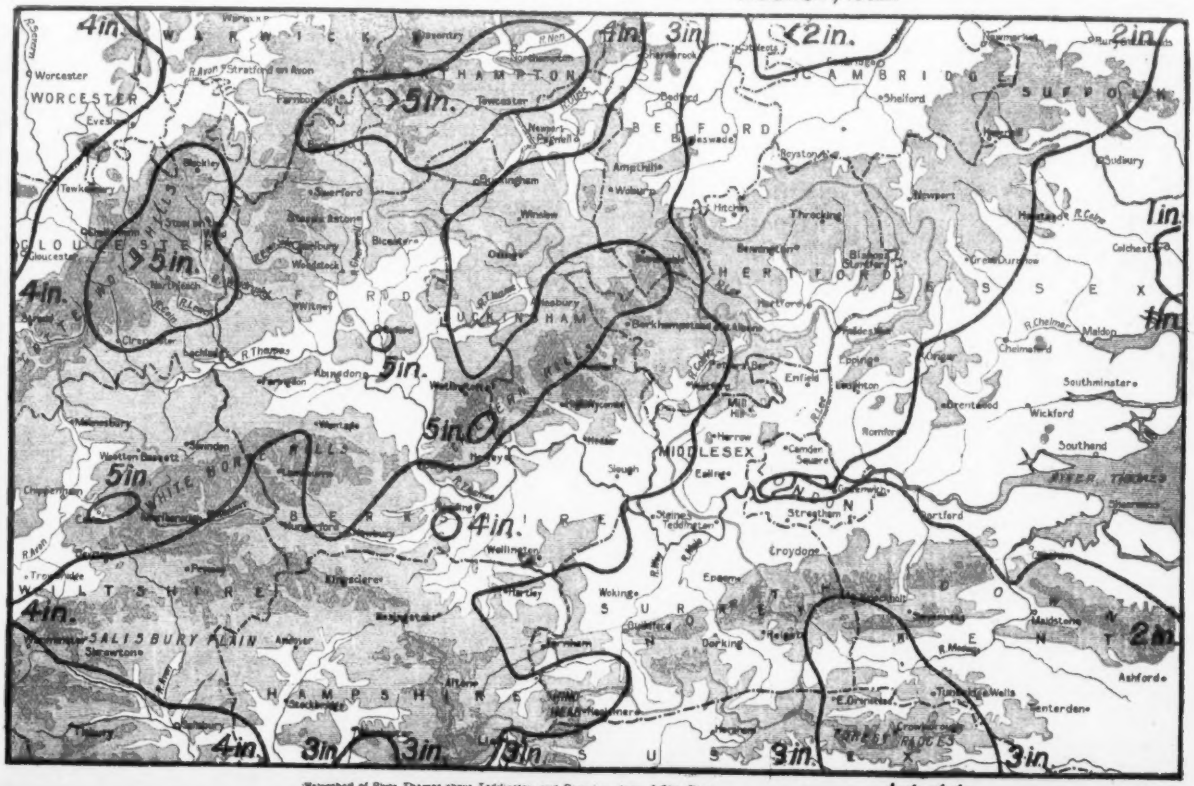
The special message from Brazil states that the rainfalls of the northern and southern regions were respectively 104 mm. and 46 mm. above normal while that of the centre was 34 mm. below normal. Rio Minas and San Paulo States had a long rainless spell. Temperature was generally high and no frosts occurred in the south.

The distribution of total rainfall was determined principally by the great rains of the 6th and 7th. More than 100 mm. (4 in.) rising in places to 150 mm. (6 in.) fell over a broad band between Cornwall and Cumberland, passing through the Midlands. In this area the fall was in many places more than twice the average. Local excesses occurred also in the centre and south of Ireland, but in nearly all other districts the rainfall of the month was slightly deficient; less than 50 mm. (2 in.) was observed in East Anglia and the Fen District, with less than 25 mm. (1 in.) locally in Essex. Less than 50 mm. (2 in.) also occurred in the neighbourhood of the Firth of Forth and the Moray Firth, as well as in parts of Perthshire. The rainy regions of the Western Highlands showed considerably smaller falls than usual, only one or two stations recording as much as 150 mm. (6 in.). Falls of more than 150 mm. (6 in.) were more widespread in the Northern Pennines, but were very local in the uplands of Wales.

The general rainfall expressed as a percentage of the average was: England and Wales, 132; Scotland, 78; Ireland, 104; British Isles, 109.

In London, Camden Square, the mean temperature was 59·1° F., or 3·3° F. below the average, the duration of rainfall 38·4 hours, and the evaporation 1·74 inch.

THAMES VALLEY RAINFALL —— AUGUST, 1922.



Watershed of River Thames above Teddington and River Lee above Feltham Weir.

ALTITUDE SCALE

© Crown Copyright reserved

Photo-Litho'd at the Ordnance Survey Office, Southampton, 1922.